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13. ABSTRACT

A number of investigators (Mackworth, 1970; Jerison, 1967; Loeb and Alluisi, 1970) have pointed to the importance of the non-signal event rate relative to vigilance performance. A recent review (Loeb & Alluisi, 1970) concluded that "..... the event rate has a proportionately greater effect on detections" than does the signal event rate. Jerison and Stenson (1965) suggested that the cost of observing the more frequently occurring stimuli results in a failure or lack of efficiency of observation. The relationship between the observations to the non-signal stimuli and number of correct detections have been inferred from the responses made to the signal events.

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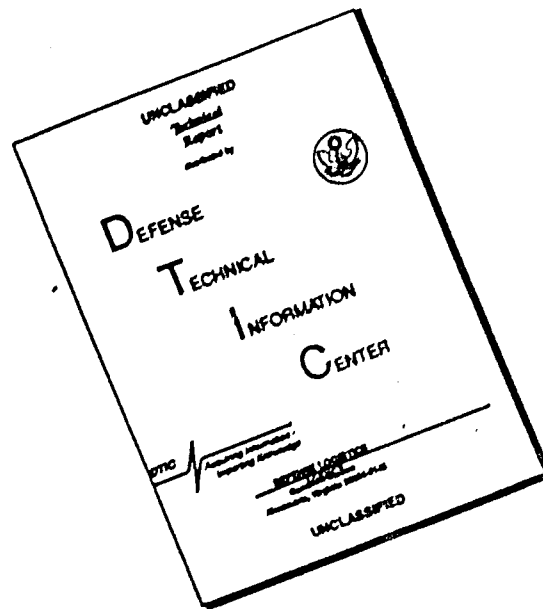
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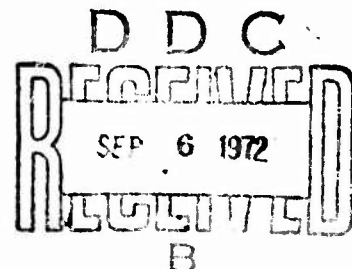
VIGILANCE PERFORMANCE AS A FUNCTION OF DIFFERENT
RESPONSE MODALITIES AND STIMULUS DURATION

As presented to the Rocky Mountain Psychology
Association Convention, June, 1972

Daisuke Bill Nakashima & Charles G. Halcomb

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A number of investigators(Mackworth, 1970; Jerison, 1967; Loeb & Alluisi, 1970) have pointed to the importance of the non-signal event rate relative to vigilance performance. A recent review(Loeb & Alluisi, 1970) concluded that "..... the event rate has a proportionately greater effect on detections" then does the signal event rate. Jerison & Stenson(1965) suggested that the cost of observing the more frequently occurring stimuli results in a failure or lack of efficiency of observation. The relationship between the observations to the non-signal stimuli and number of correct detections have been inferred from the responses made to the signal events.

A different approach to studying the more prevalent responses occurring in vigilance tasks has been suggested by a number of investigations(Wilkinson, 1957; Guarlnick & Harvey, 1970; Nakashima & Halcomb, 1972) which have required subjects to respond to both signal and non-signal events. Frankmann & Adams(1962) have criticized the inclusion of additional responses because it would change the typical performance found in vigilance tasks. Mackworth(1969, 1970) also suggested that overt responding would facilitate performance because it would decrease the effect of habituation or because the additional required discrimination would make the orienting response stronger.

Wilkinson(1957), Guarlnick, et al.(1970) and Nakashima, et al.(1972) have however, demonstrated no difference in the number of correct detections due to the additional response requirement. However, Nakashima's, et al.(1972) investigation demonstrated that subjects responding to

signal and non-signal events tend to make fewer false alarms. Wilkinson(1957) and Nakashima, et al.(1972) pointed out that the responses to the frequent non-signal stimuli becomes more or less "semi-automatic". The prevalence of making the non-signal stimulus response reduces the tendency to make false alarms. Thus, the tendency of the more frequent responses to become semi-automatic appears to reduce the number of false alarms without affecting the number of correct detections. This seems to indicate that the additional response requirement does not change the quality of observation to the display.

The trend of less false alarms with two-responses may be largely due to the characteristics of the response apparatus. Davies, et al.(1969) indicated that the ease with which the response keys can be operated may produce different response characteristics. This suggestion may be relevant to investigations of response requirements where the frequent responses to non-signal events often results in measures of what subjects expected rather than what was actually seen. Wilkinson(1957) demonstrated that subjects would often inadvertently make a non-signal response, realize that the stimulus was a signal and attempt to make the correct response. It is hypothesized that a less sensitive response indicator, requiring subjects to be more deliberate in their responding, would result in a performance characteristic different from that found in earlier studies.

The purpose of the present study was to investigate the relationship between type of response requirement, task difficulty and vigilance performance. A response

which required greater motor commitment was compared to the button pressing used by earlier investigations. The difficulty of the task was increased by decreasing the duration of the stimuli.

Procedure

One hundred and twenty general psychology students were randomly divided into two stimulus duration groups: .2 and .3 seconds. Each of these groups were further divided into four groups. The subjects were required to respond to the signal only by either pressing a button or by raising their hand to shoulder level; or they were required to respond to both signal and non-signal events by pressing separate buttons or by pressing a button for the non-signal stimuli and raising their hands to indicate the detection of a signal. Thirty signals and 1800 non-signal events were visually presented over a sixty minute period.

Results and Discussion

The results demonstrated that the type of response or the stimulus duration was not related to the number of correct detections. These findings support earlier investigations (Guarínick, et al., 1970; Nakashima, et al., 1972) indicating that the additional response does not affect the quality of observing relative to the number of correct detections.

The number of false alarms was found to be a function of type of response and stimulus duration. The additional response requirement decreased the number of false alarms,

however the type of response appears to have had a greater effect. Subjects responding to signals by raising their hands made less false alarms than those pressing the button to indicate their responses. Subjects required to raise their hands were often observed to start the movement, hesitate and return to the resting position. The sensitivity of the button pressing mechanism does not allow for such a decision change resulting in this type of response being recorded as false alarms.

Less false alarms were also produced under easier stimulus conditions, that is the .3 second stimulus duration produced less false alarms than the .2 seconds group. This effect was consistent across all conditions and not related to type of response. The effect of these variables on false alarm rate and not on correct detections support suggestions(Davies, et al., 1969; Mackworth, 1969) that false alarm rates are independent of number of correct detections.

In conclusion, the present study demonstrated that the response factor does not effect the correct detection rate. The false alarm measure seems to be more an index of the conditioning of a motor response which, as shown in the present study, is greatly effected by the sensitivity of the response measuring apparatus. Responding to both signal and non-signal events does not appear to change the quality of observing emitted by subjects responding to signals only. As Mackworth(1969) pointed out the deterioration which results in continuous responding tasks is not due to responding but occurs on the sensory side. One

further point of interest is the demonstration of double responses being emitted. In cognitive terms, it appears that there is a delay in the processing of information being held in iconic storage. However, because of the tendency for incorrect responses to occur before a correction is made, Adams' (1967) hypothesis regarding motor memory is also a plausible interpretation. The subjects response does not fit the stimulus-response memory model which results in the subject realizing the error and consequently making a correction. It seems that subtly different responses are being emitted in the vigilance situation which are not taken into account by the correct detection and false alarm measures, per se. The use of overt responses which occur more frequently than the responses to infrequent signals, may better reveal the type of responses occurring in the vigilance task.